October 2022

DEVELOPING CARDIOVASCULAR RISK ASSESSMENT MEASURES FOR PREGNANT AND POSTPARTUM PATIENTS

Research Team:

Afshan Hameed, MD, FACOG, FACC, Principal Investigator, University of California, Irvine
Heike Thiel de Bocanegra, PhD, MPH, University of California, Irvine
Maryam Tarsa, MD, MAS, University of California, San Diego
Connie Graves, MD, FACOG, University of Tennessee/St. Thomas Health Systems
Diane Wolfe, MD, MPH, FACOG, Albert Einstein College of Medicine/Montefiore Medical Center
Karen Florio, DO, MPH, FACOG, University of Missouri – Kansas City
Anna Grodzinsky, MD, St. Luke's Hospital of Kansas City

Table of Contents

BACKGROUND

The purpose of the project is to develop quality measures for CVD risk assessment among pregnant and postpartum patients and to assess its predictive value. The clinical decision tool uses 18 variables to identify patients at risk of cardiovascular disease. It was developed by Dr. Hameed with the California Maternal Quality Care Collaborative (CMQCC) and has been adopted as a guideline by the American College of Obstetrics and Gynecology (ACOG). It was piloted at UCI and has been implemented systemwide at several large health systems in California, Tennessee, Missouri, and New York. Furthermore, the aim is to perform a CVD risk assessment using a standardized tool on all (100 %) eligible pregnant/postpartum patients.

Business Rationale of Measure

Cardiovascular disease (CVD) has emerged as the leading cause of maternal mortality in the United States, accounting for over one-third of all pregnancy-related deaths. [1] Diagnosis of CVD is challenging as normal pregnancy may mimic CVD.[2] Accurate diagnosis of CVD varies widely among pregnant and postpartum patients may either result in a lack of follow-up patients who are at risk or may lead to unnecessary testing that burdens the resources in patients who are not at risk. [3] Currently, there is no indicator in the Healthcare Effectiveness Data and Information Set (HEDIS) for pregnant/postpartum patients that monitors CVD detection and/or CVD risk assessment using a validated tool.

> ***Measure 1 CVD Risk Assessment:*** Proportion of pregnant/postpartum patients that receive CVD Risk Assessment with a standardized tool.
> ***Measure 2. CVD Risk Follow-up****:* Proportion of patients with a positive CVD risk assessment who receive follow-up care.

1. CVD Risk Assessment =	Pregnant + Postpartum patients screened for CVD using algorithm	
	All pregnant + postpartum patients seen at facility without prior history of known cardiac disease	
2. CVD Risk Follow-up =	Patients who received follow up for CVD Risk	
	Patients who had a positive CVD risk assessment	

Figure 1 (above): Proposed quality measures

Population Inclusions and Data Collection from EHR

The total population in which data was collected is in OB patients: patients who have an active pregnancy or postpartum episode with at least 1 visit. This includes pregnant and postpartum minors; visits include Hospital system: Labor and Delivery; outpatient care at a hospital or in affiliated clinics; private providers contracting with the hospital for delivery. Exclusion criteria include patients with prior history of known cardiac disease and patients who have another reason for clinic visits [not prenatal or postpartum care] and have a positive pregnancy test but plan to terminate the pregnancy or seek prenatal services elsewhere. This total number of patients is the denominator for Measure 1. Each clinic site or unit can calculate its

own measure manually or with the support of its Information Technology department annually or semi-annually.

Available Tools to Assess Cardiovascular Risk

Currently, the only tool CVD risk assessment tool that is under evaluation for obstetric patients is the CVD risk assessment. It was developed by the California Maternal Quality Care Collaborative (CMQCC) developed an 18-item CVD risk assessment tool, that guides stratification and initial clinical evaluation of symptomatic or high-risk pregnant or postpartum patients. The measure was endorsed by the American College of Obstetricians and Gynecologists (ACOG) and is included in the CVD bundle of the Alliance for Innovation for Maternal Health (AIM). [4-7] The tool is designed to be implemented systemwide. [8,9] The measures can be used to assess hospital performance and the performance of clinic units and individual clinicians.[7]

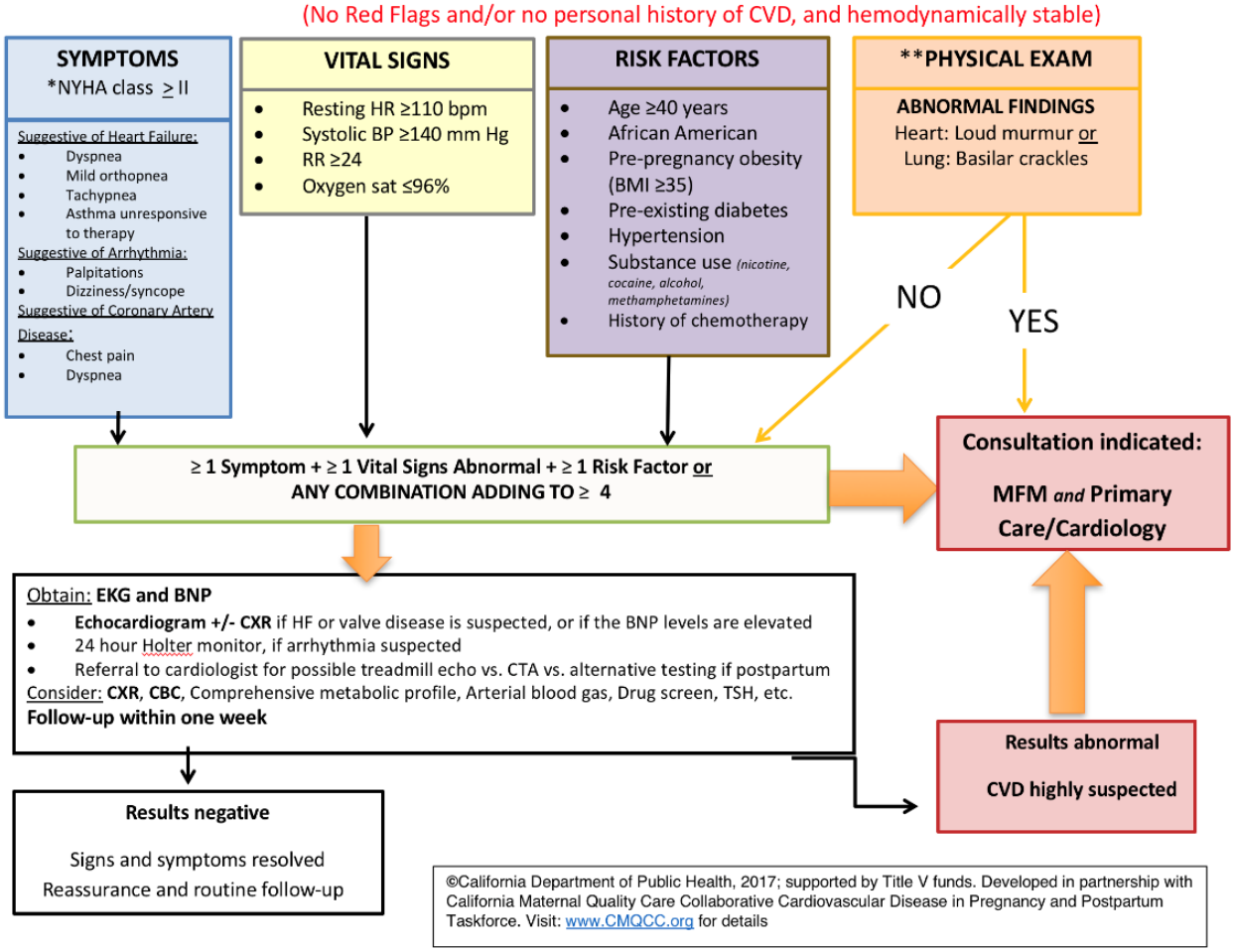

Figure 2: CMQCC CVD Risk Assessment Tool [4,5]
Abbreviations: CVD: Cardiovascular, HR: Heart rate, BP: Blood pressure, RR: Respiration rate, Oxygen sat: Oxygen saturation, BMI: Body mass index, MFM: Maternal-fetal medicine physician, BNP: B-Natriuretic peptide, EKG: Electrocardiogram (also known as ECG), CXR: Chest X-ray, HF: Heart failure, CTA: Computed tomography angiography, CBC: Complete blood count, TSH: Thyroid stimulating hormone

IMPLEMENTATION OF TOOLKIT

Clinic sites have the flexibility in how to integrate the toolkit into their clinic workflow manually or through the EHR. Based on your hospital policy, your institutional IT team may implement a hard stop that forces clinicians to complete the risk assessment.

Electronic Health Record CVD Tool Build

This tool was integrated into EPIC and Cerner EHR systems with help from institutional IT teams. The toolkit is also posted on the Ascension website, one of the largest private healthcare systems in the United States.

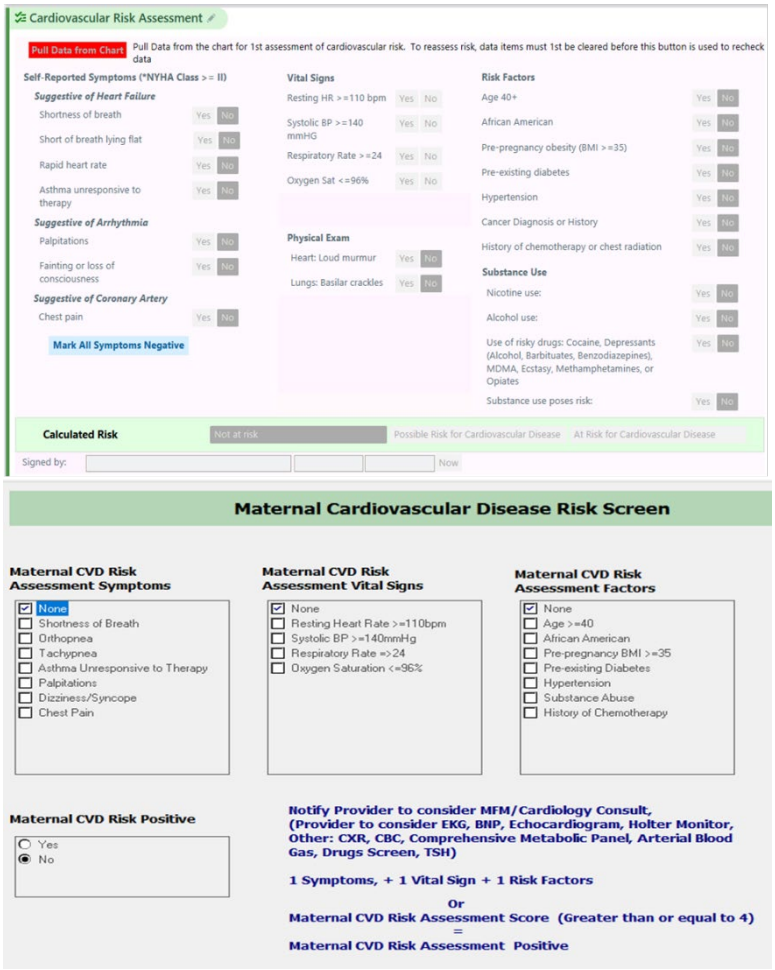

Figure 3: EPIC (above) and CERNER (below) integrated CVD Tool

Manual Tool Implementation

In one of our University of Tennessee sites the tool was implemented manually. Manual entry was done by the patient presenting for the Obstetrical Emergency Department for evaluation. The CVD was then filled out by the Registered Nurse as a hard stop. Thereafter, the provider was notified if the patient screens positive. The provider was asked to place additional orders per protocol.

*****For more information on the implementation of the tool in the EHR, you can contact our team.**

ADMINISTRATION OF TOOL

EHR Administration

Step 1: In the EHR a reminder to complete a CVD risk assessment on patients at a pregnant or postpartum office visit with the CVD tool appears as a banner on the patient chart's sidebar. Data that are already in the chart (vital signs, risk factors) will auto-populate. The clinician has the option to correct pre-populated data fields.

Step 2: The clinician has the option to mark all self-reported symptoms as negative with one click if the patient does not report any of the items.

Step 3: The clinician must manually input the substance abuse items and the physical exam items based on their exam at that office visit.

Step 4: Once all items are completed, the tool will automatically output the calculated risk into two categories: at risk for cardiovascular disease or not at risk for cardiovascular disease.

Step 5: The tool is completed when the clinician closes the navigator section. The Smartform lets the clinician sign the assessment. **Only records with a calculated risk and clinician signature are considered to have a CVD risk assessment completed.**

Step 6: Follow-up varies by the result.

- **Not at risk for cardiovascular disease**: the tool closes. The clinician can decide if the patient requires any follow-up based on items marked as positive.
- **At risk for cardiovascular disease,** – a sidebar banner instructs the clinician to follow up and provides a Smartset with potential referrals for tests and cardiovascular consults.

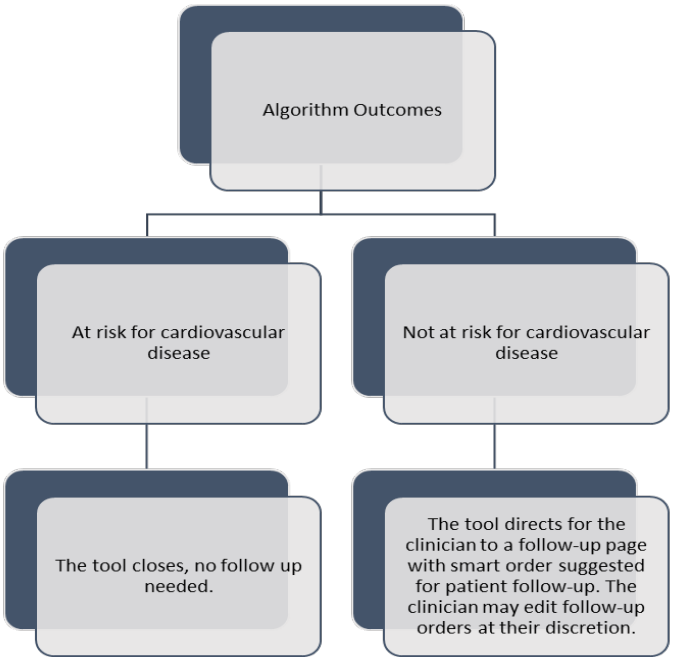

Figure 4: Flowchart of CVD Tool outcome

Step 7: Follow up on positive risk assessment for CVD:

The follow-up recommended orders include EKG and BNP:

- Echocardiogram +/- CXR if HF or valve disease is suspected, or if the BNP levels are elevated
- B-Type Natriuretic Peptide (BNP)
- Visit diagnosis: heart disease during pregnancy, antepartum [O99.419, I51.9]
- Follow-up within 1 week for Cardiovascular Risk Assessment testing results

Other orders the tool offers for the clinician to consider:

- Consult/Referral to Maternal Fetal Medicine
- Consult/Referral to Cardiology Clinic
- Consult/Referral to Internal Medicine
- Complete 2D ECHO with Image Enhancement Agent if necessary
- X-Ray Chest single view
- Holter monitor
- Thyroid cascade
- CBD w/Diff
- Comprehensive Metabolic Panel
- Arterial Blood Gas
- Drug Screen, Serum

The clinician may choose any of the recommended follow-ups based on the patient's condition. Once the follow-up smartest is signed, the follow-up orders are placed, and the tool is completed.

Manual Administration

Step 1: The patient arrives for a visit.

Step 2: The CVD risk assessment is filled out manually by a provider or can be done by a trained registered nurse.

Step 3: If completed by a registered nurse, they must flag the chart if a patient has a positive risk assessment score and notify the provider.

Step 4: The provider is asked to place additional orders per protocol.

DATA EXTRACTION OF TOOLKIT

Individual CVD risk scores will be calculated automatically once the tool is completed and will be part of the patient's health record. IT can extract clinical data on the cohort to identify subgroups in need of targeted interventions.

Data Abstracted from CVD tool in EHR

The tool is considered first complete on the date that it outputs a risk score and is signed by a clinician. From the tool and the EHR we can collect several items: the date of the finished risk assessment, the tool signed by a clinician, tool items (YES/NO), tool calculated risk, and follow-up tests ordered (see list below).

Data Abstraction Elements

- OB Patient population:
  - Patients who have a pregnancy or postpartum episode with at least 1 visit
- Medical Record Number
- Visit Dates
- Date of tool completion
- Race of Mother
- Ethnicity of Mother
- Date of Birth of Mother
- Date of Birth of Infant
- Insurance Plan
- Clinical site the patient was at when the tool was completed
- CVD Testing with dates
- Confirmed CVD with dates
- Data captured by the toolkit:
  - CVD tool items:
    - Dyspnea
    - Resting HR >= 110 Bpm
    - Systolic BP >= 140mmhg
    - RR >=24
    - O2 Sat <=96%
    - Age 40+
    - African American
    - Pre-Pregnancy Obesity
    - Diabetes
    - Hypertension
    - Hx Of chemotherapy of radiation
    - Cancer Dx Or History
    - Physical exam- Loud Murmur

        - Physical exam- Long Basilar Crackles
        - Alcohol
        - Nicotine
        - Substance Use Risk
        - Asthma Unresponsive to Therapy
        - Mild Orthopnea
        - Tachypnea
        - Dizziness/Syncope
        - Palpitations
        - Chest Pain
        - At-Risk Drugs
    - Tool signed by the clinician
    - Calculated risk outcome of risk assessment: at risk or not at risk

CVD Confirmed Extraction

CVD confirmation is identified if the patient has one or more ICD codes in their medical chart during the data abstraction time period. If CVD confirmation falls on a date prior to CVD tool use with a patient who has a completed risk assessment, they are considered an exclusion and did not require CVD tool evaluation.

If CVD confirmation falls on a date after CVD tool completion, there are two outcomes:

1. If the calculated risk was not at risk, the patient was missed by the screening tool and;
2. If the calculated risk was at risk, the patient was properly identified by the screening toolkit (see the Code Book for a full list of CVD confirmation codes).

CVD is confirmed as follows:

a) Systolic or diastolic dysfunction described on echocardiogram
b) Ventricular dilation or septal hypertrophy on echocardiogram
c) Pathologic arrhythmia confirmed by a cardiologist
d) Pulmonary hypertension diagnosed on echo or right heart catheterization
e) Valve abnormality described on echocardiogram
f) Need for cardiovascular medications which would have not been known by BP criteria alone

MEASURE ANALYSIS

CVD Risk Assessment Measure

Numerator:

The numerator consists of patients with a completed risk assessment. Individual CVD risk scores will be calculated automatically once the tool is completed and will be part of the patient's medical record.

The total population in which data was collected is OB patients: patients who have an active pregnancy or postpartum episode with at least 1 visit. This includes pregnant and postpartum minors; visits include hospital system: Labor and Delivery; outpatient care at the hospital or in affiliated clinics; private providers contracting with the hospital for delivery.

Denominator:

Any patient who is pregnant or postpartum who attends a pregnant or postpartum clinic visit at any participating site should undergo a risk assessment.

Patients (a) who have an office visit for prenatal or postpartum care at the intervention site (regardless of gestational age or prior prenatal care at other sites), (b) Any age (including pregnant and postpartum minors), (c) Outpatient OB visit at the hospital or in affiliated clinics; Labor and Delivery including private providers contracting with the hospital for delivery.

Exclusion:

[a] Patients who have another reason for visiting the clinic [not prenatal or postpartum care] and have a positive pregnancy test but have not established the clinic as OB provider (plan to terminate the pregnancy or seek prenatal services elsewhere).
[b] Prior history of known cardiac disease. CVD confirmation is identified if the patient has one or more ICD codes in their medical chart during the data abstraction period. If CVD confirmation falls on a date prior to CVD tool use with a patient who has completed the risk assessment, it is considered an exclusion and did not require CVD tool evaluation.

Data extraction for measure:

The Information Technology (IT) department extracts the number of eligible patients (Medical Record Number, visit date, denominator) and the number of patients who received a risk assessment (Date risk assessment was completed, numerator). Additional data for stratification can be clinic site, clinician, race/ethnicity of mother, insurance, gestational age, and date of birth of infant (to identify whether the assessment was completed during pregnancy or postpartum. The extraction of system and patient medical and demographic characteristics allows to identify gaps in CVD screening among patient subgroups, clinic sites or individual clinicians.

Moreover, when extracting data for analysis from the EHR, inform the Information Technology (IT) department to exclude patients with a prior history of known cardiac disease based on our Code Book. These exclusion criteria are ICD-10 codes that can be abstracted to see if they pre-exist in the patient record and used along with the CPT office visit codes to see how many patients with pre-existing conditions unnecessarily completed a risk assessment.

CVD Risk Follow-up Measure

Numerator:

Patients receiving any follow-up care directed by the tool within 60 days of positive risk assessment (positive CVD tool calculated risk and signed by the clinician). Follow-up care (i.e., CVD testing) is identified if the patient has one or more ICD codes in their medical chart during the data abstraction time. These codes need to be listed in the data abstraction with the date of input. If CVD testing falls on a date after the risk assessment tool was completed but within the 60-day window, it is determined as a follow-up to the risk assessment.

Denominator:

Pregnant and postpartum patients who have been identified to be at risk for cardiovascular disease (CVD) during the measurement period. Patients who were screened for CVD and had a pregnancy loss or stillbirth will remain in the cohort. Their patient chart is flagged with a banner and Smartset orders with recommendations for follow-up (labs/imaging/consults).

Exclusion:

Exclude patients who discontinued care (no additional visit or medical procedure within 60 days after the risk assessment documented in the electronic health record).

Data extraction for measure:

Patient medical and social variables; clinic site. Medical and demographic data on the patients allow to calculate the measure for subgroups and identify the need for targeted interventions. IT can extract clinical data on the cohort to identify subgroups in need of targeted interventions.

CONTACT INFORMATION

If you would like to learn more information about our measures or our project, you can visit our website at https://sites.uci.edu/cvdriskassessmentmeasures/.

For assistance in implementing the toolkit or any other questions, please do not hesitate to contact our project research coordinator Manija Billah at manijab@hs.uci.edu.

REFERENCES

1. Creanga AA, Syverson C, Seed K, Callaghan WM. Pregnancy-Related Mortality in the United States, 2011–2013. *Obstet Gynecol*. 2017;130(2):366-373. doi:10.1097/AOG.0000000000002114.
2. Boyd LC, Johnson T, Langston A, Mulready-Ward C, Peña J, Wilcox WC. *Pregnancy-Associated Mortality Report. New York City, 2006-2010*. New York City: New York City Department of Health and Mental Hygiene. Accessed June 14, 2019. https://www1.nyc.gov/assets/doh/downloads/pdf/ms/pregnancy-associated-mortality-report.pdf.
3. Hameed AB, Foster E, Main EK, Khandelwal A, Lawton ES. Cardiovascular Disease Assessment in Pregnant and Postpartum Women | California Maternal Quality Care Collaborative. Cardiovascular Disease in Pregnancy Toolkit. Published November 2017. Accessed June 14, 2019. https://www.cmqcc.org/resource/cardiovascular-disease-assessment-pregnant-and-postpartum-women.
4. Hameed, A., Morton, C., and Moore, A. Improving Health Care Response to Cardiovascular Disease in Pregnancy and Postpartum Developed under contract #11-10006 with the California Department of Public Health, Maternal, Child and Adolescent Health Division. Published by the California Department of Public Health, 2017.
5. Hameed, A., Main, E.K., Lawton, E., Morton, C.H., and CA-PAMR Committee. Validation Study of Cardiovascular Disease Assessment Toolfor Pregnant and Postpartum Women among Pregnancy-Related Cardiovascular Deaths in California, 2002-2006. Unpublished analysis. 2015. California Maternal Quality Care Collaborative at Stanford University. Palo Alto, CA
6. Improving Health Care Response to Cardiovascular Disease in Pregnancy and Postpartum | California Maternal Quality Care Collaborative. Accessed November 20, 2018. https://www.cmqcc.org/resources-toolkits/toolkits/improving-health-care-response-cardiovascular-disease-pregnancy-and.
7. Crosland, BA., Blumenthal, E., Senderoff, D., et al. Heart of the Matter: A Preliminary Analysis of the California Maternal Quality Care Collaborative Cardiovascular Disease Toolkit. Annual Conference, Society of Maternal Fetal Medicine, Las Vegas; February 2019.
8. Hunter S, Robson SC. Adaptation of the maternal heart in pregnancy. *Br Heart J*. 1992;68(6):540-543. doi:10.1136/hrt.68.12.540.
9. Greenland P, Alpert JS, Beller GA, et al. 2010 ACCF/AHA guideline for assessment of cardiovascular risk in asymptomatic adults: A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Circulation*. 2010;122(25):e584-636. doi:10.1161/CIR.0b013e3182051b4c.